REMARKS

Reconsideration of this application is requested.

Upon entry of the attached amendment, claims 1-10 will be pending in this application for the Examiner's review and consideration. Claim 11 has been canceled, and claims 1-2 and 6 have been amended herein. Claim 1 has been amended to narrow the range of y in Ga_y from "$0 \leq y \leq 0.7$" to the preferred range of "$0.1 \leq y \leq 0.3$." Support for this amendment can be found in the specification, for example, on page 6, lines 13-16. Claims 2 and 6 have been amended to recite that the units of electrical resistivity are in "Ωm", not "Ωcm". One of ordinary skill in the art would have understood the original units to be in error. To further clarify, however, applicants have amended the specification to ensure consistent use of the units "Ωm." Applicants note that the units were correctly denoted in certain portions of the specification as "Ωm" prior to this amendment to the specification. See, for example, page 6, line 27. Claim 6 has also been amended to narrow the range of x in In_x from "$0.2 \leq x \leq 1.0$" to the preferred range of "$0.3 \leq x \leq 0.8$." Support for this amendment can be found in the specification at, for example, page 6, lines 13-16. Additionally, claim 6 has been amended to recite that "the composition has a non-amorphous structure." This simply excludes one of the embodiments of composition (B) disclosed in the specification. See, for example, page 4, lines 12-14.

As discussed above, applicants respectfully note the submission of a substitute specification which corrects the units of electrical resistivity. Applicants note that a clean version of the substitute specification is submitted as well as a separate, marked up version showing the changes in the specification relative to the previous version. The substitute specification contains no new matter.

Claim Rejections Under 35 U.S.C. § 102/103

Claims 6-10 were rejected under 35 U.S.C. § 102(b) as anticipated by, or, in the alternative, under 35 U.S.C. § 103(a) as obvious over O'Leary *et al.*, "Electron transport in wurtzite indium nitride," J. Appl. Phys., 83(2), pages 826-829, January 15, 1998 ("O'Leary") for the reasons discussed on pages 2 and 3 of the Office Action. Applicants respectfully request reconsideration for the reasons that follow.

The present invention relates to a nitride or oxynitride thermoelectric material which has a low electrical resistivity (of nitride) and a high absolute value of a Seebeck coefficient such that it can be employed as a thermoelectric element in thermoelectric conversion. The nitride thermo electric material has an element composition represented by formula (B): $Al_zGa_yIn_xM_uR_vD_wN_m$,
wherein M represents a transition element; R represents a rare earth element;
D represents at least one element selected from elements of the Group IV or II;
$0 \leq z \leq 0.7$, $0 \leq y \leq 0.7$, $\underline{0.3 \leq x \leq 0.8}$, $0 \leq u \leq 0.7$, $0 \leq v \leq 0.05$, $0 \leq w \leq 0.2$, and $0.9 \leq m \leq 1.1$; and $x+y+z = 1$. The value of x has been amended herein from "$0.2 \leq x \leq 1.0$" to "$0.3 \leq x \leq 0.8$." An additional limitation was added to the claim to recite that the composition has a non-amorphous structure.

O'Leary evaluates the transport characteristics for InN, GaN and GaAs. Of these compounds, only InN can be understood in some way to overlap with the scope of the elemental composition recited in independent claim 6 prior to its amendment herein. As discussed below, however, the compounds of O'Leary do not overlap with the composition of formula (B) in claim 6, as amended. Furthermore, O'Leary, while teaching the material physical values and sonic velocities related to the effective mass and stoichiometric composition of InN or GaN, does not teach the Seebeck coefficient (50 μV/K) and electrical resistivity (10^{-3} Ωm or less) recited in claim 6.

As discussed, the InN compounds disclosed in O'Leary do not overlap with the composition of formula (B) recited in claim 6, as amended. Nor does O'Leary suggest compounds which would fall within the scope of the composition of formula (B). Moreover, applicants respectfully submit that one of ordinary skill in the art would not have any reasonable expectation of success in preparing the compositions of amended claim 6 based on O'Leary's teachings, as O'Leary does not teach or suggest the claimed stoichiometric relationship of elements which can be present in the composition of formula (B). It is further worth noting that O'Leary does not teach or suggest any composition with the properties recited in claim 6 (*i.e.*, an absolute value of a Seebeck coefficient of 50 μV/K or more at a temperature of 100°C or more, and an electrical resistivity of 10^{-3} Ωm or less). Accordingly, O'Leary neither anticipates nor renders obvious claim 6, as amended. Nor does O'Leary anticipate or render obvious claims 7-10, which depend from claim 6.

Claims 6-9 and 11 were rejected under 35 U.S.C. § 102(b) as anticipated by, or, in the alternative, under 35 U.S.C. § 103(a) as obvious over U.S. Patent No. 4,365,107 to Yamauchi ("Yamauchi") for the reasons discussed on page 3 of the Office Action. Claim 11 has been canceled, thus obviating its rejection. Applicants respectfully request reconsideration of the rejection of claim 6-9 for the reasons that follow.

Yamauchi describes an amorphous film solar cell of p-i-n heterojunction type and the material of the amorphous film. Yamauchi also describes that the amorphous film is made of a Group III-V compound semiconductor, which can be produced through the combination of Group III elements (B, Al, Ga and In) and Group V elements (N, P, As and Sb).

Applicants respectfully submit that Yamauchi does not teach or suggest each and every limitation of amended claim 6 of the present invention. For example, Yamauchi does not teach a composition of formula (B) which has a non-amorphous structure. Yamauchi is strictly directed to amorphous materials. Nor does Yamauchi teach or suggest a nitride material with an absolute value of a Seebeck coefficient of 50 μV/K at a temperature of 100 °C or more and an electrical resistivity of 10^{-3} Ωm or less. For at least these reasons, Yamauchi does not anticipate or render obvious claims 6-9 of the present invention.

Claims 1-5 were rejected under 35 U.S.C. § 102(b) as anticipated by, or, in the alternative, under 35 U.S.C. § 103(a) as obvious over Steffes *et al.*, "New $In_xO_yN_z$ films for the Application of NO_2 sensors," Sensors and Actuators B, vol. 77 (2001), pages 352-358 for the reasons discussed on pages 3 and 4 of the Office Action. Applicants respectfully request reconsideration for the reasons that follow.

Steffes is directed to indium oxynitride ($In_xO_yN_z$) films manufactured by sputtering and used in gas-sensing applications. The film is manufactured by introducing N_2 in the production process of In_2O_3; the average content of N is described as 1.9%. However, there is no further detailed measurement regarding x, y and z.

Claim 1 of the present invention recites an oxynitride thermoelectric material which has an element composition represented by the following formula (A):

$$Al_zGa_yIn_xM_uR_vO_sN_t$$

wherein M represents a transition element; R represents a rare earth element; $0 \le z \le 0.7$, $0.1 \le y \le 0.3$, $0.2 \le x \le 1.0$, $0 \le u \le 0.7$, $0 \le v \le 0.05$, and $0.9 \le s+t \le 1.7$ so that the

element composition is an oxynitride, and $0.4 \leq s \leq 1.2$; and $x+y+z = 1$. The material has an absolute value of a Seebeck coefficient of 40 μV/K or more at a temperature of 100°C or more. The value of y has been amended herein from "$0 \leq y \leq 0.7$" to "$0.1 \leq y \leq 0.3$."

Applicants respectfully submit that Steffes does not teach or suggest all of the limitations of claim 1 of the present invention. For example, Steffes does not teach or suggest a composition which includes Al or Ga, particularly noting that, with the amendment of the range of "y" in claim 1, Ga is always present. Moreover, Steffes does not disclose or suggest enough technical information which could be used by one of ordinary skill in the art to predict the Seebeck coefficient recited in claim 1. For at least these reasons, Steffes does not anticipate or render obvious claim 1 of the present invention. Nor would Steffes anticipate or render obvious claims 2-5, which depend from claim 1.

Additionally, there is no motivation or suggestion in Steffes to modify the reference to produce the nitride thermoelectric materials of the present invention. Steffes is related to indium oxynitride films used in gas-sensing applications, not thermoelectric materials used in thermoelectric conversion. Steffes, moreover, does not disclose values of a Seebeck coefficient. One of ordinary skill in the art would not be able to predict the value of the Seebeck coefficient from the disclosure in Steffes. Accordingly, there is no motivation in Steffes to modify the reference to produce the features of the claimed invention. Nor would there be any reasonable expectation of success in applying the data disclosed or suggested in Steffes to produce the claimed invention. For these additional reasons, Applicants respectfully submit that one cannot establish a *prima facie* case of obviousness with respect to the Steffes reference.

Reconsideration with allowance is requested.

Respectfully submitted,

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